

ISBN 0-7729-4016-9

**PHYTOTOXICOLOGY ASSESSMENT SURVEY
OF LEAD AND OTHER METALS
IN SOIL AND VEGETATION
IN THE VICINITY OF
WESTMOUNT AVENUE AND THE QUEENSWAY
HIGHWAY (Hwy. 417), OTTAWA
JULY 1987**

AUGUST 1988



**Environment
Ontario**

**Jim Bradley
Minister**

ISBN 0-7729-4016-9

**Phytotoxicology Assessment Survey
of Lead and Other Metals
in Soil and Vegetation in the Vicinity of
Westmount Avenue and the Queensway
Highway (Hwy. 417), Ottawa - July 1987**

ARB No. : 018-88-PHYTO

AUTHOR : R. Emerson

AUGUST 1988

c Queen's Printer for Ontario, 1988

**Phytotoxicology Assessment Survey of Lead and
Other Metals in Soil and Vegetation
in the Vicinity of Westmount Avenue and
the Queensway Highway (Hwy. 417), Ottawa - July 1987**

Introduction

At a public meeting in 1987 which was organized by the area MPP (E. Gigantis) at the request of a citizens' group, area residents expressed concern about high traffic volume and vehicle speed on Westmount Avenue. Westmount Avenue is a narrow residential street which neighbours, and runs parallel to, the north side of the Queensway highway (Hwy. 417) which is a major traffic artery in Ottawa. Westmount Avenue is used as the Queensway off-ramp to Parkdale Avenue, with the off-ramp being at the east end of Westmount (see attached map). Residents were concerned that the high traffic volume was resulting in contamination of their properties as a result of vehicle emissions of lead and other metals. In light of the latter concern, the Environment Ministry representative at the meeting (Mr. D. Harrison, MOE, Ottawa) requested that an assessment survey be conducted by the Phytotoxicology Section.

On July 28 and 29, 1987, staff of the Phytotoxicology Section sampled properties on Westmount Avenue and in other neighbourhoods nearby to determine the status of lead and other metals in soil and vegetation in these areas.

Soil and Vegetation Samples Collected for Analysis

On July 28 and 29, 1987, surface soil was collected in the front yard and/or backyard (if accessible) of thirteen residential properties on Westmount Avenue, with all properties being situated between the Queensway off-ramp and Parkdale Avenue (Area A on attached map). Private properties on more remote residential streets including Edgar

Street (5 properties) and St. Francis Street (4 properties) to the north of the Queensway, and Young Street (7 properties) to the south, also were sampled (Areas B, C and E on map). In addition, soil samples were collected from a public park (Area D on map) which was just south of the Queensway and across from Westmount Avenue. In all areas, soil was collected primarily from lawn areas. In each residential area (Areas A, B, C, E), soil from at least one garden additionally was sampled. Soil at all lawn sites was collected at a depth of 0-5 cm with a stainless steel soil corer, whereas gardens were sampled at usual tilled depth (0-15 cm) with a hand shovel. Duplicate soil samples were collected at each site.

In addition to soil collection, foliage samples were collected from several Manitoba maple trees. In Area A (Westmount Ave.), Manitoba maple foliage was sampled at the east end of Westmount between Westmount Avenue and the Queensway. Foliage from two Manitoba trees which were growing just south of the Parkdale intersection, closer to the west end of Westmount, also was collected. The tree sampled in the former area beside the off-ramp was sampled on both the north side (facing Westmount) and south side (facing Queensway). In the latter area, the Manitoba maple tree closest to the Parkdale intersection was sampled on the north side facing Westmount, with a neighbouring Manitoba to the south being sampled on the south side facing the Queensway. Moreover, in Area D (public park), two Manitoba maple trees, which were about 60 m apart and adjacent to the noise barrier along the south shoulder of the Queensway, were sampled on the north side facing the Queensway. Finally, in Area E (Young Street), foliage from the north side of two Manitoba maples, which were situated approximately 100 m apart and adjacent to the noise barrier on the south side of the Queensway, additionally was sampled. As with soil, duplicate samples were collected at each site.

Submission for Chemical Analysis

All soil and foliage samples were returned to the Phytotoxicology Section laboratory for processing and were submitted for analysis on a dry weight basis to the MOE Laboratory Services Branch. The samples were analyzed for lead and other metals (cadmium, chromium, copper, vanadium, zinc) which could be potentially emitted by vehicle traffic.

Analytical Results for Soil

The soil results revealed that metal levels in soil generally were higher in the residential areas sampled to the north of the Queensway highway than in the areas sampled to the south. Of the three residential areas (Areas A, B, C) sampled to the north of the highway, the highest metal levels in surface soil generally were detected on Westmount Avenue (Area A) in the area of concern (see Tables 1 - 3 attached).

Lead Concentrations in Soil

On Westmount Avenue, soil was collected at a total of 22 sites (on 13 properties). Only one site (a backyard lawn with 675 ppm lead) was found to have a slightly "above-normal" soil lead concentration compared to the Phytotoxicology Section "upper limit of normal" lead guideline (500 ppm) for urban surface soil.

However, on the basis that normal soil lead levels (<500 ppm) were detected at all other soil collection sites on Westmount and in the other areas sampled, and that the property with the elevated backyard soil lead level (675 ppm) had a much lower soil level in the front yard (270 ppm), it is very doubtful that the one "above-normal" soil lead level found on Westmount Avenue was related solely to vehicle emissions. Other sources (old paint peeling from buildings, metal objects in soil, contaminated fill added to property) also can contribute to levels of lead and other metals being elevated in soil.

Nevertheless, the soil lead mean for the Westmount area (290 ppm) was elevated relative to the means (69 - 201 ppm) for the other areas sampled north and south of the highway (see Table 3). Therefore, it would appear that the high traffic volume on Westmount Avenue may have contributed to the general lead elevation found in this area. The soil lead mean (201 ppm) for the Edgar Street residential area (Area B) to the east (the properties sampled on this relatively low-traffic street were away from the off-ramp and also neighboured the north side of the Queensway) was only slightly lower, and the soil lead mean (171 ppm) for the St. Francis Street area (Area C), further north of the highway, was further reduced. The fact that soil lead levels decreased with distance to the north of the Queensway would indicate that traffic emissions from the Queensway highway have contributed to the overall soil lead elevation which was found in the areas sampled to the north of the highway, including the Westmount area.

However, on the basis that only one site (of the total number of 57 sampled) was found to have a slightly above-normal (>500 ppm) soil lead level (which the data indicated was unlikely related solely to vehicle emissions), it is concluded that vehicle traffic on Westmount Avenue and/or the Queensway highway has resulted in only minor lead contamination of the soil on neighbouring properties.

Cadmium, Chromium, Copper, Vanadium and Zinc Concentrations in Soil

Soil levels of cadmium, chromium, copper, vanadium and zinc in the Westmount area (Area A) were not found to be markedly different from the concentrations found in the other sampling areas to the north of the Queensway (see Tables 1 & 3).

Soil concentrations of the above-noted elements in all sampling areas, with the exception of chromium at two sites in the Westmount area, were below the Phytotoxicology Section "upper limit of normal" guidelines for urban surface soil. On one property on Westmount Avenue, soil chromium levels in the front yard (84 ppm) and backyard (90 ppm) were

slightly above the respective guideline (50 ppm). However, in relation to the Phytotoxicology Section soil clean-up guideline of 1000 ppm for chromium recommended for the decommissioning of industrial land for residential/parkland use even the highest soil chromium levels are no cause for concern.

Soil concentrations of cadmium, copper and zinc (but not chromium and vanadium) generally were slightly higher in the three sampling areas (Areas A,B and C) to the north of the Queensway than in the two areas (Areas D & E) south of the Queensway. The same general pattern occurred for lead. It is suspected that this pattern at least partly reflects differences in land use history (i.e. age of development), rather than being entirely attributable to vehicle emissions from the Queensway.

Analytical Results for Foliage

The foliar results (see attached Table 4) revealed that the metal results for all foliage sites, including the highest lead (13 ppm) and chromium (1.5 ppm) levels which were detected in foliage facing the intersection of Westmount and Parkdale Avenues, were very low compared to the "upper limit of normal" guidelines for urban tree foliage.

These results would indicate that current vehicle traffic on Westmount Avenue and the Queensway highway is a very minor source of emissions of lead and other metals. Therefore, on the basis of the foliage results, it would appear that the soil levels of metals, particularly lead, which were found in the Westmount area and in the other neighbourhoods sampled are largely due to historic, as opposed to current, emissions.

Summary and Conclusion

In summary, the three residential areas (Westmount Avenue, Edgar Street, St. Francis Street) sampled to the north of the Queensway highway generally had higher soil metal (cadmium, copper, lead and zinc) levels than the two areas (public park, Young Street) sampled to the south, with the highest metal levels being detected on Westmount

Avenue in the area of concern. Of the total number of soil sites sampled (57), only one site (a Westmount Avenue backyard lawn with a soil level of 675 ppm lead) had a lead level of greater than 500 ppm, the Phytotoxicology Section "upper limit of normal" lead guideline for urban surface soil. However, on the basis that only this site had an "above-normal" soil lead level, it is doubtful that vehicle emissions were solely responsible. Soil levels of cadmium, chromium, copper, vanadium and zinc detected in the Westmount Avenue area and in the other neighbourhoods sampled generally were of no cause for concern.

In addition, metal concentrations in the foliage samples that were collected at all sites which neighboured the Queensway, including those on Westmount, were found to be very low when compared to the Phytotoxicology Section "upper limit of normal" guidelines for urban tree foliage. The low foliage results indicate that current vehicle traffic on both Westmount Avenue and the Queensway is a minor emitter of lead and other metals. Therefore, it would appear that the generally higher soil levels of metals, particularly lead, that were detected on Westmount Avenue and in the other areas sampled to the north of the Queensway are largely historic.

On the basis of the soil and vegetation results, it is concluded that vehicle traffic on Westmount Avenue and/or the Queensway highway has resulted in only minor metal contamination on neighbouring properties.

RE2004

En 1987, lors d'une réunion publique organisée par la députée locale (E. Gigantes) à la demande d'un groupe de citoyens, les résidents de l'avenue Westmount se sont montrés soucieux de la forte circulation et de la vitesse des véhicules dans l'artère en question. L'avenue Westmount est une voie résidentielle étroite qui jouxte parallèlement le côté nord du Queensway (autoroute 417), importante voie de circulation d'Ottawa. Cette avenue sert de bretelle de sortie du Queensway vers l'avenue Parkdale, sortie se situant à l'extrémité est de l'avenue Westmount (voir la carte ci-jointe). Les résidents craignaient que la forte circulation n'entraîne une contamination de leur propriété du fait de l'émission de plomb et d'autres métaux par les véhicules. Le représentant du ministère de l'Environnement présent à la réunion (M. D. Harrison, Ottawa) a alors demandé que la Section de phytotoxicologie procède à une analyse de la situation.

Les 28 et 29 juillet 1987, le personnel de la section a prélevé, dans les propriétés de l'avenue Westmount et de rues avoisinantes, des échantillons de sol et de végétation pour voir s'ils contenaient du plomb ou d'autres métaux.

En résumé, la teneur en métaux (cadmium, cuivre, plomb et zinc) du sol prélevé dans les trois zones résidentielles (avenue Westmount, rue Edgar et rue St-François) situées au nord du Queensway était en général plus élevée que celle du sol prélevé dans les deux zones (jardin public et rue Young) se trouvant au sud. La teneur était la plus élevée dans l'avenue Westmount, c'est-à-dire dans le secteur préoccupant. Sur le nombre total (57) de sols échantillonnés, un seul (une pelouse à l'arrière d'une maison de l'avenue Westmount, avec 675 ppm de plomb) dépassait la limite supérieure de 500 ppm établie par la Section de phytotoxicologie pour les régions urbaines. Cependant, compte tenu du fait que c'est le seul endroit où la teneur en plomb du sol dépassait les normes, il est douteux que les émissions des véhicules soient les seules responsables. La teneur en cadmium, en chrome, en cuivre, en vanadium et en zinc des sols du quartier de l'avenue Westmount et des autres voisinages n'était en général pas préoccupante.

Nous avons de plus trouvé que les concentrations de métaux dans les échantillons foliaires recueillis à tous les endroits avoisinant le Queensway, y compris ceux de l'avenue Westmount, étaient très basses comparées à la limite supérieure établie par la Section de phytotoxicologie pour le feuillage en milieu urbain. Ces résultats indiquent que la circulation actuelle dans l'avenue Westmount et sur le Queensway émet peu de plomb et d'autres métaux. Il semblerait donc que la teneur en métaux - et

notamment en plomb - relativement plus élevée des sols de l'avenue Westmount et des autres secteurs échantillonnés au nord du Queensway remonte à longtemps.

À partir des résultats obtenus pour les sols et pour la végétation, nous en avons conclu que la circulation automobile dans l'avenue Westmount ou sur le Queensway n'entraînait qu'une légère contamination par les métaux des propriétés avoisinantes.

Sampling Areas Relative to Westmount Avenue and the Queensway,
Ottawa - July, 1987.



Area A - Westmount Avenue

Area B - Edgar Street

Area C - St. Francis Street

Area D - Public Park

Area E - Young Street

TABLE 1: Soil Metal Concentrations Detected on Residential Properties in the Westmount Avenue Area and in the Other Areas Sampled to the North of the Queensway - July 1987.

Location	Average* Concentration (ppm, dry wt.) in Soil*											
	Front Yard						Back Yard					
	Cd	Cr	Cu	Pb	V	Zn	Cd	Cr	Cu	Pb	V	Zn
<u>Area A on Figure</u> (North of Queensway)	<u>Westmount Ave. Residential Area (Area of Concern)*</u>											
Westmount Ave. ^s lawn	1.9	<u>84</u>	44	345	36	180	2.3	<u>90</u>	54	465	36	245
Westmount Ave. ^s lawn	1.1	27	68	250	31	235	0.4	25	22	37	41	59
Westmount Ave. ^s lawn							0.9	29	42	340	36	200
Westmount Ave. ^s lawn	0.7	27	29	270	35	135	1.5	30	68	<u>675</u>	38	450
Westmount Ave. ^s lawn	1.2	49	41	325	33	210	1.2	37	46	385	34	325
Westmount Ave. ^s lawn	0.6	27	22	145	29	106	1.2	27	39	395	36	290
garden							1.0	32	43	230	41	280
Westmount Ave. ^s lawn	0.8	31	42	305	39	265	0.7	29	34	215	40	140
garden							0.5	26	29	140	33	120
Westmount Ave. ^s lawn	0.8	29	34	365	37	150	1.1	26	43	370	32	180
Westmount Ave. ⁿ lawn	1.0	31	31	270	38	175	1.1	31	26	180	38	180
Westmount Ave. ⁿ lawn	1.3	31	55	400	31	315						
Westmount Ave. ⁿ lawn	0.7	30	29	205	28	165	0.5	22	15	95	22	95
Westmount Ave. ⁿ lawn	0.8	33	27	155	32	115						
Parkdale Ave. ⁿ lawn	0.8	31	80	195	34	170						
<u>Area B on Figure</u> (North of Queensway)	<u>Edgar St. Residential Area</u>											
Edgar Street ⁿ lawn	1.0	35	31	240	42	245	0.8	31	25	140	35	170
Edgar Street ⁿ lawn	0.9	41	29	200	47	165						
Edgar Street ⁿ lawn	0.6	30	19	175	34	130						
Edgar Street ⁿ lawn	1.8	43	48	475	44	470	0.4	32	13	48	32	79
Edgar Street ⁿ lawn	0.6	34	34	130	42	105						
garden	0.7	36	33	170	45	135						
<u>Area C on Figure</u> (North of Queensway)	<u>St. Francis St. Residential Area</u>											
St. Francis St. ^w lawn	0.8	29	27	220	39	165	1.2	45	50	255	50	355
St. Francis St. ^w lawn	0.6	30	22	140	31	94	1.2	31	87	155	40	175
garden							1.1	31	40	100	39	145
St. Francis St. ^e lawn	0.5	31	25	115	32	99	0.3	23	13	16	26	33
St. Francis St. ^e lawn	1.6	36	25	320	36	195	0.7	34	25	145	36	155
U L N**	4	50	100	500	70	500	4	50	100	500	70	500

Note: Westmount Avenue and Edgar Street run east and west.

St. Francis Street runs north and south. n - Property on north side of street; s - on south side; w - on west side; e - on east side.

* Average of duplicate sample results.

* Surface soil was collected at a depth of 0-5 cm from lawns; 0-15 cm from gardens.

** Phytotoxicology Section "upper limit of normal" guidelines for urban surface soil (0-5 cm).

Results underlined are in excess of the respective guidelines.

TABLE 2: Soil Metal Concentrations Detected in Areas Sampled to the South of the Queensway - July 1987.

Location	Average* Concentration (ppm, dry wt.) in Soil*										
	Front Yard						Back Yard				
	Cd	Cr	Cu	Pb	V	Zn	Cd	Cr	Cu	Pb	Zn
<u>Area E on Figure</u> (South of Queensway)	<u>Young St. Residential Area</u>										
Young St. ^s lawn	0.6	33	16	102	39	93					
Young St. ^s lawn	0.5	24	18	100	32	124					
Young St. ^s lawn	0.5	27	17	81	38	67					
Young St. ⁿ lawn	0.6	35	26	150	45	105	0.7	41	27	155	46 125
Young St. ⁿ lawn	0.3	33	16	59	32	61	0.7	29	23	195	39 135
Young St. ⁿ lawn	0.4	39	26	69	41	71					
Young St. ⁿ lawn garden	0.4	29	20	60	36	66	0.5	30	23	130	37 80
							0.5	30	27	69	36 97
<u>Area D on Figure</u> (South of Queensway)	<u>Public Park South of Westmount Avenue</u>										
Playfield:											
N end - lawn	0.3	32	15	49	32	62					
S end - lawn	0.5	35	18	89	44	72					
Swing area - lawn	0.5	31	29	51	30	83					
- sand	<0.2	18	10	12	22	22					
Lawn Bowling Club:											
- lawn	0.4	35	24	87	39	95					
U L N**	4	50	100	500	70	500	4	50	100	500	70 500

Note: Young Street runs east and west. n - property on north side of street; s - on south side.

* - Average of duplicate sample results.

** - Surface soil was collected at a depth of 0-5 cm from lawns; 0-15 cm from gardens.

** - Phytotoxicology Section "upper limit of normal" guidelines for urban surface soil (0-5 cm).

TABLE 3: Soil Data Summary Showing the Range (R) and Mean (M) of the Soil Metal Concentrations Detected in Each Sampling Area - July 1987.

Range (R) /Mean (M)	Soil Concentration (ppm, dry wt)					
	Cd	Cr	Cu	Pb	V	Zn
<u>North of Queensway</u>						
Westmount Avenue - Area A on figure (22 sites*)						
R	0.4 - 2.3	22 - 90	15 - 80	37 - 675	22 - 41	59 - 450
M	1.0	35	41	290	34	199
Edgar Street - Area B (7 sites*)						
R	0.4 - 1.8	30 - 43	13 - 34	48 - 475	32 - 47	79 - 470
M	0.9	35	28	201	39	195
St. Francis Street - Area C (8 sites*)						
R	0.3 - 1.6	23 - 45	13 - 87	16 - 320	26 - 50	33 - 355
M	0.9	32	34	171	36	159
<u>South of Queensway</u>						
Young Street - Area E (10 sites*)						
R	0.3 - 0.7	30 - 41	16 - 27	59 - 195	32 - 46	61 - 125
M	0.5	32	21	110	39	93
Park - Area D (4 sites*)						
R	0.3 - 0.5	31 - 35	15 - 29	49 - 89	30 - 44	62 - 95
M	0.4	33	22	69	36	78
U L N**	4	50	100	500	70	500

* - Lawn sites where surface soil was collected at 0-5 cm.

** - Phytotoxicology Section "upper limit of normal" guidelines for urban surface soil (0-5 cm).

TABLE 4: Metal Concentrations Detected in the Maple Foliage Samples Collected in the Westmount Avenue Area and in the Areas Sampled to the South of the Queensway - July 1987.

General Site Location	Average ⁺ Concentration (ppm, dry wt.) in Foliage					
	Cd	Cr	Cu	Pb	V	Zn
<u>Sites North of Queensway*</u>						
Westmount Ave. (Area A on figure)						
1. Between off-ramp and Queensway, E end of Westmount Ave.	<0.1	<1	Foliage Facing Queensway 8	5	<1	19
	<0.1	<1	Foliage Facing Westmount 6	4	<1	17

2. Between Westmount and Queensway, just S of intersection with Parkdale Ave.	<0.1	<1	Foliage Facing Queensway 6	6	<1	16
	<0.1	1.5	Foliage Facing Westmount 8	13	<1	22
<u>Sites South of Queensway*</u>						
Park (Area D)						
1. NW corner area	<0.1	<1	Foliage Facing Queensway 7	6	<1	19
2. Top centre area	<0.1	<1	8	7	<1	15

Young St. (Area E)						
1. ~ 200 m E of Fairmont Ave.	<0.1	1	8	7	<1	21
2. ~ 300 m E of Fairmont Ave.	<0.1	<1	5	3	<1	10
U L N**	3	8	20	60	5	250

+ - Average of duplicate results.

* - Foliage sites were neighbouring Queensway.

** - Phytotoxicology Section "upper limit of normal" guidelines for urban foliage.